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ABSTRACT

To evaluate test speededness and to derive implications for test program activity, this document presents an annotated bibliography on studies of test speededness. The 64 citations range from 1902 to 1976, and include the seminal articles by Cronbach and Warrington (1951) and Gulliksen (1959); articles which summarize the previous literature on the topic somewhat; articles which offer indices for consideration; and studies that report empirical data on test speededness. (PN)

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GRADUATE RECORD EXAMINATIONS

AN ANNOTATED BIBLIOGRAPHY OF STUDIES OF TEST SPEEDEDNESS

Thomas F. Donlon

GRE Board Research Report GREB No. 76-9R

March 1980

This report presents the findings of a research project funded by and carried out under the auspices of the Graduate Record Examinations Board

EDUCATIONAL TESTING SERVICE, PRINCETON, NJ

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Introduction

In 1975, the Graduate Record Examinations Board funded a small-scale project on the techniques for the appraisal of test speededness. The project was primarily focused on evaluating various indices for their potential application to the program, and is reported as GRE Program Report, GRE No. 76-9 "An Exploratory Study of The Implications of Test Speededness." As part of the study, a literature search was projected.

Within the limitations of the project, this search could not be fully comprehensive. Further limitations were encountered when it was discovered that the topic of test speededness had received no systematic treatment by the major literature archives: the literature on test speededness was essentially unorganized.

In the summer of 1976 two graduate students were made available to the project at no cost under a study program sponsored by ETS. The students were able to research the abstracts and to identify a larger block of aproximately 100 studies broadly related to the topic. Many of them were fairly old. Because the search process had proved to be so difficult, and because the topic is one of enduring interest to test developers and users, it was decided to abstract a number of these articles and to offer them as an annotated bibliography.

The task of abstraction was not simple. Many of the articles reflected idiosyncratic approaches to the subject. They built toward judgments based on complex analysis and definition unique to the author. How much of this material to reflect or include was problematic. In the end, a decision was made to hold the abstracts to a brief minimum, characterizing the sense or gist of the article, rather than its structure or content. The goal is to assist a future worker in identifying likely sources of information to be investigated, rather than to provide a basis for acceptance or rejection of the results.

The articles show in the aggregate the surprising diversity of approaches. They include the "seminal" articles by Cronbach and Warrington (1951) and by Gulliksen (1959). There are articles which summarize the previous literature on the topic somewhat, as in Rindler's (1975) NCME paper. Stafford (1971) and Donlon and Reilly (1976) offer indices for consideration. A number of the studies report empirical data on test speededness.

The studies here reported will be added to in the future. It is the intention to expand and update this bibliography periodically, to facilitate the consideration of issues relating to speed in the future. The present collection, therefore, represents an initial effort to assist researchers in this area.

Aitkens, H. A., Thorndike, E.L., & Hubbell, E. Correlations amongst perceptual and associative processes. Psychological Review, 1902, 11, 374-382.

This study explored the relationship between performance on a speeded addition test and scores composed of separate measures on three tests of association. The association tests required that an examinee write, within a certain time limit, (1) an antonym for a given word and (2) that letter in the alphabet preceding a given letter. The authors did not conduct a statistical analysis but simply described their data. They contend that their results suggest that skills which appear to be similar may actually be independent specializations.

Anastasi, A. & Drake, R. An empirical comparison of certain techniques for estimating the reliability of speeded tests. Educational and Psychological Measurement, 1954, 14, 529-540.

This study compared four methods for estimating the reliability of speeded tests. These four were:

1. The Spearman Brown, odd-even
2. Guttman's L_4, odd-even
3. Guttman's L_4 separately timed halves
4. Cronbach and Warrington's, lower bound

These reliability estimates were computed on data generated from the administration of the SRA tests of Primary Mental Abilities to a group of high school students. Five subtests from this battery were employed: verbal-meaning, space reasoning, number, and word fluency. The results indicated that, except in the case of the verbal-meaning subtest, the odd-even techniques yielded reliability estimates which were spuriously high when compared to estimates computed with the Guttman L_4 separately-timed halves procedure. Both the Gulliksen and the Cronbach and Warrington methods were used to determine the extent to which a test is speeded, and to estimate the lower bounds of single-trial reliability coefficients.

Bernstein, E. Quickness and intelligence. British Journal Psychol. Monograph Suppl., 1924, 7.

To provide evidence for the existence of a speed factor which operates independently of a general ability factor "G", the author studied 28 youths (average age, 14) for quickness of response. The youths were tested at four different speed levels on each of five different tests:

1. sentence completion
2. directions
3. concomitants
4. analogies
5. moral classification

In addition, the author observed the students unobtrusively while they played or worked at various assigned tasks. The results of the analyses conducted on the test score data indicated that (1) the existence of a "speed" ability is doubtful, (2) perseverence does not generally cause slowness although it may have operated in individual cases, and (3) practice does not materially affect a student's performance. No statement could be offered regarding the relative merits of long and short tests. The results of the author's observation exercises suggested that differences in rate of response could be traced to one or more of the following factors: differences in interest, conative differences, physical defects, differences in temperament, perseverance, or domination by some inherent aim, i.e., accuracy.

Burack, B. Relationship between course examination scores and time taken to finish the examination, revisited. Psychological Reports, 1967, 20, 164.

To investigate the relationship between course examination grades and the order in which the students finish their exams, the author administered two tests composed of multiple choice and short answer items to students in an introductory psychology class. Other students enrolled in a social psychology class were given two tests containing essay items. The rank order correlations between exam grade and order of completion for the group of introductory psychology students were .03 and -.15; these correlations for the other group of students were -.02 and .15. The author concluded that confounding factors had perhaps concealed a true relationship between the two variables. However, he also adds that if enough time is provided for a course examination, it is not likely that high achievers will turn in their papers first.

Bush, E. S. & Dweck, C. S. Reflections on conceptual tempo: Relationship between cognitive style and performance as a function of task characteristics. Developmental Psychology, 1975, 11 (5), 567-574.

This study was conducted to determine the effects of two variables, conceptual tempo and test anxiety on the performance of individuals engaged in speeded tasks. Conceptual tempo was defined as the degree to which an individual considers alternative possibilities on problem-solving tasks which involve some degree of uncertainty. One hundred fourth grade students were given the Matching Familiar Figures (MFF) test, a test commonly used to measure conceptual tempo. Those scoring above the median were classified as reflectives; those scoring below labeled impulsives. The same students were also given the Test Anxiety Scale for Children (TASC) and the Lie Scale for Children (LSC); thus high and low anxiety students could be identified. Four groups of students evolved from the results of this initial testing:

1. high-anxious reflectives
2. low-anxious reflectives
3. high-anxious impulsives
4. low-anxious impulsives

Two months later, all were administered a highly speeded set of three tests which stressed quick decision-making. The authors predicted that the high-anxious reflectives would perform best; however, this group's performance only equaled that of low-anxious reflectives, but both groups of reflectives performed better than the impulsive groups. These findings prompted the authors to offer a definition of cognitive style that stressed the strategy or conceptual tempo of an individual rather than his disposition.

Courtis, S. A. The relation between rate and quality in educational measurement. Journal of Educational Research, 1924, 10, 110-131.

To investigate the relationship between rate and quality of performance in handwriting, 1500 elementary school children were asked to submit samples of their handwriting eleven different times: five times under normal conditions, three times under conditions which emphasized rate, and three which stressed quality. Rate was defined as the number of letters written per minute; quality was determined by two experts who used the Ayres Scale to judge the handwriting. The results of the analyses conducted indicated that no single formula can be derived to correct for the speed component in these kinds of test scores. The author suggests that those whose experiments involve handwriting skills should heed the complexities of the speed and quality factors.

Cronbach, L. J. & Warrington, W. G. Time limit tests: Estimating their reliability and degree of speeding. Psychometrika, 1951, 14, 167-188.

This paper presents a theoretical and empirical investigation of several procedures for computing reliability estimates for differentially speeded time-limits tests. The authors demonstrate mathematically that the split-half and K-R methods produce coefficients which are grossly inflated. The derivations are extended to create a lower bounds formula which corrects for spuriousness in the estimates. Several methods, including Gulliksens's, and one proposed by the authors, are then compared empirically with data generated from an administration of four kinds of mental tests: arithmetic reasoning, number series, sentence completion, and spatial relations. The major conclusion is that a split-half single-trial estimate cannot be interpreted unless it is also accompanied by evidence that the degree of spuriousness is negligible. Furthermore, those factors which cause the split-half coefficient to be inflated also operate on the Kuder-Richardson formulas. The concept of test speededness is explored, and general recommendations for handling its inherent problems are offered.

Donlon, T. F. Estimating rate-of-work parameters in the assessment of test speededness. Paper presented at the annual meeting of NCME, 1975.

The author first critically examines four major speededness indices:

1. Gulliksen's variance ratios
2. Cronbach and Warrington's dual administration procedure
3. Stafford's single-administration indices
4. Swineford's dual criteria employed by ETS

He then discusses a graphic technique initially introduced by Evans and Reilley, which plots the percentage of candidates who are still working at various points during the testing period. He extends this basic concept and re-defines the abscissa in terms of rate of work parameters. This refinement leads to a suggestion that the average time required to permit non-finishers to complete the test be expressed as a percentage of the present time allotment and that this be considered an index of speededness. Donlon also presents three other indices developed from a model which assumes the rate of work is normally distributed. The plausibility of this assumption and the utility of each of the indices is explored empirically with data from seven tests. The results of the analyses of six of the seven tests indicate that the three indices are quite useful for assessing test speededness.

Donlon, T. F. & Reilley, R. Estimating speededness parameters on several tests. Paper presented at the annual meeting of NCME, 1976.

This study extends the previous work of both authors on the use of examinees' rate-of-work scores as one index of test speededness. They present data which support their contention that rate-of-work scores are normally distributed. The results of a plotting technique are presented. This technique requires that the distribution of observed points be plotted on normal probability paper. The plot is then visually assessed for linearity. Donlon and Reilley also conduct a chi-squared goodness test to determine the congruency between the frequencies they observe and those which they derived theoretically from their rate-of-work model. These methods are applied to data from seven tests. The tests include:

1. GRE Aptitude Tests
2. GRE Engineering Test
3. LSAT Logical Reasoning and Practical Judgment Test
4. LSAT
5. GMAT
6. SAT

The authors conclude that the results of the plotting generally support their normality assumption while the results of the goodness-of-fit test do not.

Dowd, C. E. A study of the consistency of rate of work. Arch. Psych., 1926, 84, 1-33.

To determine the extent to which work rates remain consistent across various types of performances, the author administered several speeded tests measuring hand movement, writing, reading, arithmetic, and intelligence to a group of 165 six grade students. Most of the correlations observed between work rates and scores on the various tests were low. High correlations were obtained only between the scores on tests of similar content. These results do not support the notion of a general speed component of test scores. The author concludes that the individual who performs one task quickly has only a slight tendency to perform the other tasks at a quick rate.

Dubin, J. A., Osburn, H., & Winick, D. A. Speed and practice: Effects of negro and white test performances. Journal of Applied Psychology, 1969, 53, 19-23.

The investigation was conducted to determine whether three methods used to improve test performance were as fair for black as for white students. The three methods were: (1) extra test practice, (2) extra test time, and (3) extra practice and extra tiem. Black and white students in grades nine through twelve were divided into four groups: S1, S2, P1, and P2. The S groups were administered speeded tests while the P groups received power tests; the groups classified as "1's" were comprised of students in the ninth and tenth grades while groups classified as "2's" were eleventh and twelfth graders. The tests employed were two parallel forms of each of four Employee Aptitude Survey (EAS) subtests. Groups S1 and P1 were administered both forms of the Numerical Reasoning and Space Visualizaiton Tests. Groups S2 and P2 received both forms of the Verbal Reasoning and Numerical Ability Tests. The results of the analyses performed failed to support the hypothesis that blacks benefit more from extra practice and/or extra testing time. The authors conclude by offering several explanations for their results.

Dubois, P. H. A speed factor in mental tests. Arch. Psychology, 1932, 141 (38), 5-38.

This experiment sought to demonstrate the existence of speed as a component of mental behavior. Two types of tests, level and speeded, were administered to 233 white, male college students. The items on the latter parts of the level tests were very difficult, so that an extension of the time limits would not have appreciably affect the scores. The speed tests were composed of very simple mental test items; the difficulty level was approximately the same throughout. Alterations in the time limits would have been reflected in score fluctuations of considerable size. Specifically, the tests included: an arithmetic reasoning tests, a vocabulary test, two batteries of five tests designed to reflect different levels in speed; the Minnesota Paper Form Board tests and the Haggarty reading examination. A factor common to the speed tests was observed, but it did not influence the level tests to any great extent.

Ellis, R. S. A method of constructing and scoring tests given with time limits to eliminate or weight the effect of speed. School and Society, 1928, 28, 205-207.

The author presents a method for building and scoring time-limit tests which can be employed when one wishes to either eliminate or to weight the effect of speed. His method requires a large item pool. From this pool two parallel tests are developed. These are administered as a total test which is so long that no examinee can finish it, but nearly all can complete the first half. The advantage of using tests of this type is that nearly all the students will have been measured on the entire domain of content, but the faster ones will have been measured again on some part of the content. Scores on those items contained in the second half of the test can either be ignored if the speed factor is to be eliminated, or weighted, if it is to be considered.

Evans, F. R. & Reilly R. R. A study of speededness as a source of test bias. Journal of Educational Measurement, 1972, 9 (2), 123-131.

This study investigated the effect of test speededness on LSAT candidates in regular and predominately black fee-free centers. Candidates in both types of centers were split into two comparable groups where one received an increased number of items in the same time. The results showed: (1) the test is slightly more speeded for fee-free candidates, (2) reducing speededness produces higher scores for both sets of candidates, (3) reducing speededness is not more beneficial to either group of candidates, and (4) increasing speededness produces a lower KR-20 in the fee-free sample.

Evans, F. R. and Reilly, R. R. A study of test speededness as a potential source of bias in the quantitative score of the admission test for graduate study in business. Research in Higher Education, 1973, 1, 173-183.

To determine whether bias which might exist due to a speed factor in the ATGSB could be eliminated by increasing the time limit for the test, minority and majority groups were given a section of the test under varying time conditions. Three specific groups were identified: (1) fee-paying black candidates, (2) fee-paying white candidates, and (3) non-paying black candidates. Examinees in each group were assigned one of three special tests. These were administered under a speeded, a normal, or an unspeeded condition. The varying degree of speededness on each test was achieved by manipulating the number of items on each while maintaining a constant time limit for each of forty minutes. The results of the analyses indicated that raising or lowering the time allotted per item had no appreciable effect on the scores attained. This suggests that such a prodecure would not eliminate any bias possibly due to speededness.

Fornsworth, P. R., Seashore, R. H., and Tinker, M. A. Speed in simple and serial actions as related to performance in certain intelligence tests. J. Genet Psychology, 1927, 34, 537-551.

This study explored the interrelations of speed in simple action, serial discrimination action, and verbal intelligence tests of varying degrees of difficulty. The tests administered were the Army Alpha, the Otis Advanced, and the Thorndike. The experimenter employed a modification of the Weiss-Renshaw ink polygraph to record the time taken by each subject to respond to each item. The Ohio State Examination could not be timed in this way because the examinees were permitted to refer to a given paragraph as often as it was necessary. The Alpha, Otis, and Ohio State tests were scored in four ways other than time per item: (1) number of items answered correctly in standard time, (2) number of items answered correctly in unlimited time, (3) amount of time needed to complete the test, and (4) the unlimited time score divided by the total time score (this was defined as the efficiency score). The results of the analysis indicated that: (1) there was no relationship between serial action and simple action, (2) the measures of serial action and simple action were highly reliable, (3) slightly negative correlations existed between serial action and simple action, and (4) moderate, positive correlations existed between serial action and each of the intelligence tests.

Fossum, J. A. An application of techniques to shorten tests and increase validity. Journal of Applied Psychology, 1973, 53 (1), 90-92.

The paper presented the results of a study conducted by a large private computer technology organization. The study examined the effectiveness of two item selection techniques which purported to reduce testing time and increase the validity of tests employed to select programming computer maintenance students. The first technique requested a sequential accretion of items so that at each iteration the item selected was the one which resulted in the largest increase in the correlation of the test and the criterion. The second method selected and accumulated the items in the order of their declining item point biserial correlations with the criterion. Both techniques selected items which significantly increased the validity of the computer maintenance selection test and decreased the time to take it. However, although the two techniques selected items which diminished the time necessary to take the programmer test, these items did not increase the test's validity.

Freeman, F.A., The factors of speed and power in tests of intelligence. Journal of Experimental Psychology, 1931, 14, 83-90.

The purpose of this study was to examine whether three prominent intelligence tests are primarily speed or primarily power. The three tests investigated were: the National Intelligence Test, the Otis Advanced Examination, the Terman Group Test of Mental Ability. The first of these tests was given to sixth graders, the second to eighth graders, and the third to eleventh graders. During the initial testing session, the standard time limits for each test were enforced. The following day the tests were administered again, but the examinees were permitted to spend as much time as they needed to complete them. A small group of students taking each test was identified as "slow but accurate." However, the author concludes that these three tests are primarily power tests.

Freeman, F. N. Note on the relation between speed and accuracy or quality or work. Journal of Educational Research, 1923, 7, 87-89.

To examine the relationship between speed and score on two standarized mental tests, the author administered the tests which measured mastery of course content to 114 students enrolled in his classes. The order in which students completed their exams was recorded; this order was used to assign a speed of performance score to each student. Low correlations between the speed and quality scores on both tests were observed. The author concludes that the speed with which one finishes an exam is not related to the quality of his performance.

Freeman, F. S. The factor of speed. J. Genetic Psychology, 1932, 6, 462-468.

To study the factor of speed as an influence upon scores on the Ohio State Psychological Test, the author administered this test to 117 Cornell University students first with the usual time limits and the second time, several months later, without time limits. A greater homogeneity in test results was observed when the time factor was eliminated. Students who originally placed in the lower deciles gained more when they performed without time limits than those in the upper deciles. This indicates that speed is an essential factor for this test. A correlation coefficient was computed between scores on the two administrations; it was not as high as expected. The author argues that there are a few examinees whose true level of achievement are not revealed when time limits are imposed.

Freeman, F. S. Power and speed: their influence upon intelligence test scores. Journal of Applied Psychology, 1928, 12, 631-637.

To assess the relative contributions of power and speed in determining scores on the Dearborn Group Test, Freeman administered four sections of the test to one hundred children in grades 4 through 7 under speeded and unspeeded conditions. Correlations were computed between the speeded and unspeeeded scores obtained on the four sections and the total battery. The results indicated that the Dearborn Group Test is principally a power test.

Furneaux, W. D., Some speed, error, and difficulty relationships within a problem-solving situation. Nature, V. 170, 37-38, 1952.

This paper introduces several probability functions which are applicable to the study of speed, error, and difficulty relationships on mental tests. These functions are: (1) Pc, the probability that a particular problem will occupy the problem solver for some amount of time; (2) Pe, the probability that a solution recored within this working time will be a correct one; (3) Ps, the probability that a particular correct solution will be returned within a period of t seconds after the moment the problem is presented. The author states that no comprehensive statement can be offered concerning a persons ability to solve a problem which does not involve these three probabilities. Thus, any attempt to measure intelligence should include assessments of Pc, Pe, and Ps. He concludes with a discussion of their limitations.

Gates, A. I. An experimental and statistical study of reading and reading tests. Journal of Educational Psychology, 1921, 12, 303-314, 378-391, 445-464.

This series of three articles presented the results of an extensive experimental and statistical investigation of twelve widely used reading tests: (1) Brown's Silent Reading Test, Forms I and II; (2) The Burgess Scale, P.S., No. 1; (3) Courtis' Silent Reading Tests, No. 2, Forms I and II; (4) Monroes's Silent Reading Test; (5) Thorndike's Scale for the understanding of sentences, Alpha 2; (6) Thorndike-McCall Reading Test, Forms I and II in grades II through VII, forms 1 through 5 in grades IV and VI; (7) Gray's Oral Reading Test; (8) Woodworth-Wells Directions Test; (9) Holley's Sentence Vocabulary Test; (10) a vocabulary test arranged by the author; (11) a pronounciation test arranged by the author; (12) Thorndike's Visual Vocabulary Test. Approximately 20 students in each grade from III through VII participated in the study. All students attended the same school. The author employed six criteria in the process of evaluating the usefulness of the twelve tests. The criteria considered: (1) the tests reliability, i.e., the ability of the test to measure an individual's score consistently over time; (2) the tests objectivity, i.e., its potential for producing the same results when administered by different experimenters; (3) the proper definition and equalization of the test's units; (4) the adequacy of the test norms; (5) the tests ability to differentiate among level of reading skill and to provide a sufficiently wide range of scores; (5) the test equivalency of the various forms of the tests. Each of the 12 tests was scrutinized by the author. In his summary, he first discusses reading ability generally; he then offers several conclusions concerning tests for measuring reading rate and those for assessing reading comprehension.

Gulliksen, H. The reliability of speeded tests. Psychometrika, 1950, 15, 259-269

Gulliksen introduces several methods for estimating the reliability of partially speeded tests. An important advantage of these techniques is that they do not require an additional administration of a parallel form of the test. The reliability estimates computed with these new methods are compared with those calculated form several traditional ones. Data for these comparisons are scores from 12 pairs of various types of tests. In addition, a thorough discussion and derivation of reliability formulas for both pure and partially speeded tests is offered. Finally, a method for calculating the mean and standard deviation of the "number unattempted score" is proposed as an alternative to rescoring the anwser sheets.

Hendel, D. D. Test format and administration variables as related to the performance of metally retarded adults on multifactor tests of vocational abilities. Proceedings form the 79th Annual Convention of the APA, 1971, 6, 615-616.

The effects of test format and administration variables on the performance of mentally retarded adults were examined in this study. Four hypotheses were tested, only one of which concerned test speededness. This one stated that the administration of a test under nonspeeded conditions improves the performance of retarded individuals. Groups of retarded adults, high school students, and college students were given the GATB under speeded and unspeeded conditions. Scores were obtained by dividing the number of items correct by the number of items attempted. The mean scores of all three groups were significantly higher under the speeded condition.

Hunsicker, L. M. A study of the relationship between rate and ability. Teachers College Contributors to Education, 1925, No. 185.

This study examined the relationship between rate of work and mental ability. Arithmetic and sentence completion tests were arranged so that each page contained items of near equal difficulty. Furthermore, the items on a given page were more difficult than the ones on the page preceeding it. One examiner tested 163 students either individually or in small groups, recording the time needed by each student to complete a page. A rate of work score was defined as the amount of time required to complete the first two pages of a test. The point at which students could obviously no longer achieve success was designated as the power or ability score. Moderately high correlation coefficients were observed between the rate and power scores. The author concludes that a relationship exits between the two.

Jackson, P. H. & Novick, M. R. Maximizing the validity of a unit weight composite as a function of relative component lengths with a fixed total testing time. Psychometrika, 1970, 35, 33-347.

A solution to the problem of assigning relative weights to the subtests of a test so as to maximize validity of a unit weight composite when the total testing time is fixed is presented in this paper. Even though this technique cannot guarantee absolute optimal validity in all instances, it is useful in those situations where the researcher must use unit rather than regression weights when combining the component scores. This situation occurs when subtests are combined to form the overall scale score. In addition, algorithms are developed so that the least total testing time required to attain specified multiple and composite correlations can be determined.

Klineberg, O. An experimental study of speed and other factors in "racial" differences. Arch. Psychol., 1928, 241.

To determine the effects of speed and other factors on the performance of Indians, Whites, and Negroes on intelligence tests, the author administered the Pinter-Patterson (PP) series to several samples of children, ages 7 to 16 years. Separate analyses were conducted of the speed and accuracy scores for the various groups. The results suggested that the differences observed were due to environmental factors and not to race. The superiority of the White children's performance on the tests to that of other groups could be attributed primarily to the speed scores. The accuracy scores of the Whites were not superior to any of the other races.

Knapp, R. R. The effects of time limits on the intelligence test performance of Mexican and American subjects. Journal of Educational Psychology, 1960, 51, 14-20.

To investigate the effects of time limits on the intelligence test performance of Mexican and American subjects, Knapp administered the Cattell Culture Free Intelligence Test to one hundred Mexican immigrants and to one hundred Americans. The two groups of subjects were given the Cattell Test under speeded and unspeeded conditions. An analysis of variance of the examinees' scores produced significant main effects for culture, test condition, session, and order at the .001 level. The culture effect reflected a large overall difference between the test scores of the two groups. The significant effect for test condition indicated that both of the groups had higher mean scores under the power conditions. The session effect suggested that, when the speed test was given first, the scores of both groups were detrimentally affected. The results of the analysis further demonstrated that examinees maintained their relative positions in the group from the first administration to the second. The author concludes emphatically that the imposition of time limits on a cross-cultural intelligence test was more detrimental to the performance of the Mexicans than to the performance of the Americans.

Lambeth, M. and L. H. Race differences in speed of reaction. Pedagogical Seminary and Journal of Genetic Psychology, 1933, 42, 255-297.

The purpose of this study was to investigate differences between Negroes and Whites in their speed of reactions on performance tests. Previous investigations of race differences in reaction speed were briefly surveyed. In addition, the problems in Klineberg's work were discussed. Thirty Negro and thirty White twelve-year-old boys were given: (1) The Stanford-Binet Test, viewed as not involving time to any appreciable degree; (2) The Rational Learning Test, a partially speeded ingenuity test; (3) six speeded performance tests. A large, statistically reliable difference wa observed between the mean scores of the two groups on the Stanford-Binet; this difference favoring the Whites. Two groups, one composed of 14 Negroes, the other of 14 Whites were formed. Subjects within the groups had been matched on the Stanford-Binet. The median performance of the whites was compared to that of the Negroes; the latter groups excelled on eight of the ten criteria.

Lanier, L. H. The interrelations of speed and reaction measurement. Journal of Exp. Psych., 1934, 13, 371-399.

The results of four experiments designed to investigate the interrelations of 'speed' in different types of activities were presented. Performance on a wide range of activities was studied in the initial experiment which was conducted to determine whether the interrelationships observed among the speed scores would reveal any consistent trends across activities. The second experiment was quite similar to the first, except the few activities were investigated and a more homogeneous group of subjects was employed. White and Negro 20 year-old males served as subjects for the third experiment; otherwise, the procedures followed were the same as for the first two studies. The relationship among speed scores on activities known to be integrated at different neural levels were studied in the fourth investigation. The author concludes tentatively that: (1) speed is not conditioned uniformly in all activities by some unitory factor or set of factors; (2) speed of reaction is not the product of a single organic variable, such as rate of nerve conduction; (3) the size of the correlation between measurements of speed of various types of reactions appears to vary somewhat directly with the similarity in the postural and effector mechanisms involved in any pair of relations correlated.

Lemmon, E. W. The relation of reaction times to measures of intelligence, memory, and learning. Arch. Psych., 1927, 94.

To explore the relationship between speed of reaction and certain measures of intelligence, memory, and learning, the author administered several tests to a group of 100 students attending Columbia College. Although the investigation was limited to response to visual stimulation, both simple and descriminative reactions were studied. The Thorndike Intelligence Examination for High School Graduates was employed to measure intelligence. The tests used to measure memory were the Logical Memory Tests, the Auditory Paired Associates Tests, and the Visual Paired Associates Test; those used to assess learning ability were the Turkish-English Test, The Digit-Symbol Substitution Test, and the Code Scale. The results of the analyses conducted supported the conclusions which follow: (1) A positive correlation was observed between discrimination reaction speed and simple reaction speed; however it appeared that the discrimination task became more difficult, the correlation decreased. (2) The correlations between simple reaction speed and scores on the intelligence, memory, and learning tests differed from the correlations between scores on these tests and the discriminative reaction speed; the latter varied with the difficulty of the discrimination task. (3) Low positive correlations were observed between simple reaction speed and the score on each of the memory, learning, and intelligence tests. (4) The results obtained from the Peak and Boring study were not confirmed. (5) The regression equation which expressed intelligence in terms of simple and discriminative reaction speeds, memory, and learning demonstrated that, as predictors on intelligence, memory, and learning they are two to six times as important as either type of reaction speed.

Line, W. and Kaplan, E. The existence, measurement and significance of a speed factor in the abilities of public school children. Journal of Experimental Education, 1932, 1, 1-8.

Two experiments were conducted to examine that part which speed contributes to intelligence tests scores. The first was concerned with identifying a speed factor other than G. Fourth grade students were given an intelligence test under shortened, normal, and extended time conditions. The authors performed a tetrad analysis and concluded, cautiously, that speed appears to be a factor other than G. The second experiment was undertaken to explore this "other" speed factgor. A battery of relatively easy tests, containing items of approximately equal difficulty, was administered to a group of third grade students. The scores on these tests were correlated with age, sex, school, grades, intelligence test scores, number of misdemeanors, preservation. The authors concluded that: (1) younger children received higher speed scores; (2) speed scores were not related to school grades; (3) the relationship between speed and intelligence isnot clear; (4) there were no significant sex differences in the speed scores received; (5) the slower students committed a greater number of misdemeanors; (6) speed was not related to preservation.

Longstaff, H. P. & Porter, J. P. Speed and accuracy as factors in objective tests in general psychology. Journal of Applied Psychology, 1928, 12, 638-642.

To investigate individual differences in speed and accuracy scores, the authors analyzed data generated from 14 weekly examinations to 186 university students enrolled in a general psychology class. A student's speed score was defined as the total amount of time he needed to complete a test. His accuracy score was defined as the total number of items he answered correclty. A correlational analysis of the speed and accuracy scores indicated that little, if any, relationship existed between the two scores on these tests.

Lord, F. M. A study of speed factors in tests and academic grades. Psychometrika, 1956, 21 (1), 31-50.

This study explored the factors of speed in tests. Six hundred forty-nine students in the entering class of the U. S. Naval Academy received seven tests in each of the three areas (vocabulary, spatial reactions, and arithmetic reasoning) under four conditions of test speededness: high, moderate, slight and unspeeded. Scores from these tests were correlated with one another and also with five academic grades. (In order to avoid producing speed factors which might have been attributed to common features in the shapes of the score distribution of the tests, e.g., slowness, all variables were normalized before the product moment correlatins were computed.) Lawley's maximum likelihood method of factor analysis was conducted. Although ten significant factors were extracted, the structure of the factor matrix was interpreted for the first nine only. As expected, three of the nine factors obtained were verbal, spatial and mathematical reasoning factors. A general academic grade factor and a verbal academic grade factor were also identified as well as a verbal-speed and spatial-speed factor. All four speed factors were positively intercorrelated thus suggestng the existence of a general speed factor at the second order level. The results of this study indicated that speed of various types influenced the course grades examined; therefore, speededness in the admissions examinaiton seemed justified. However, it appeared that only very highly speeded tests involved the speed factors necessary to support these generalizations.

Manson, G. Personality differences in intelligence test performance Journal of Applied Psychology, 1925, (9) 2, 230-255.

This study was conducted to explore some personality factors which cause examiners to have different omission-of-items rates on intelligence tests. Two groups of graduate students, one comprised of business majors, the other of education majors, participated in the study. The author secured these student's scores on a battery of intelligence tests. Other instruments administered to participants were designed to measure (1) a "caution" personality variable, (2) a "caution" variable attributable to certain motor activities, and (3) a self report "caution" variable. To obtain information concerning the differences in omission rates among examinees, the author examined the scores from these "caution" measures in additon to data generated from comparisons of the speed, error, and omissiveness scores on the intelligence tests. She also interviewed each examinee. She observed several factors which appeared to influence rate of item omission: (1) the form in which the test question and answer was presented, (2) the difficulty of the test question, (3) the instructions which were given, (4) the tendency for some examinees to report only those items which they believed they had answered correctly. The author concluded that the influence of cautiousness, itself, on omissiveness behavior, is extremely complex.

McFarland, R. A. The role of speed in mental ability. Psychological Bulletin, 1928, 25, 595-612.

The research concerning the role of speed in mental ability is reviewed. Three general, but not mutually exclusive, categories of studies are examined: (1) those in which speed of reaction was explored in connection with sensation, perception and/or the simpler psychological processes; (2) those in which the relationship between speed of reaction and scores on measures of the more complex mental processes such as attention, imagination, or memory was studied; (3) those conducted to determine the correlation between rate of response and scores on general intelligence or specific ability measures.

McLeod, L. A. The interrelations of speed, accuracy, and difficulty. Journal of Experimental Psychology, 1929, 12, 431-443.

This study explored the relationships between speed of response, accuracy of response, and the difficulty of the items on a spelling test. The test itself was composed of 665 spelling words arranged in random order. It was given to 75 undergraduate college students. The words were presented orally, and time of response was recorded by means of a stop watch. The author concludes that: (1) individuals are likely to maintain approximately the same relative speed even though the difficulty level of the item varies; (2) individuals tend to retain their relative standings in accuracy even when the difficulty level of the items changes; (3) a positive correlation exists between speed and accuracy scores.

Michael, W. B., Steward, R., Douglass, B. & Rainwater, J.H. An experimental determination of the optimal scoring formula for a highly speeded test under different instrucitons regarding scoring penalties. Educational and Psychological Measurement, 1963, 23, 83-99.

To determine whether the level of performance on highly speeded tests is affected by the type of scoring formula employed and/or the type of test instructions given, the researchers administered a highly speeded clerical aptitude test to young adult males and manipulated both the test instructions the examinees were offered and the methods by which the tests were scored. The amount of information contained in the instructions concerning guessing was varied. There were three sets of instrucitons each of which represented an information level: (1) the first offered no comment concerning a penalty for guessing; (2) the second encouraged the examinee to guess and advised him that there was no scoring penalty for guessing; (3) the third warned the examiree of the consequences of guessing and indicated that a scoring penalty would be enforced. For each of the three sets of instructions, four scoring methods were employed. Those methods computed the score by: (1) summing the number of correct responses; (2) summing the number of correct responses and then subtracting one-half the number of incorrect ones; (3) summing the number of items omitted. The results indicated that: (1) when the first three scoring methods were employed, a net increase in average level of performance occurred when guessing was encouraged; however a net decrease in performance occurred when guessing was discouraged; (2) the fourth scoring method yielded the highest alternate forms reliabilities, coefficient; when the alternate forms reliabilities coefficient for the first three methods were compared, the highest was provided by the first scoring method. The best combination of test instructions and scoring formula appeared to be those instructions which mentioned a penalty for guessing and that formula which counted the number of correct responses only. However, it would obviously be unethical to employ this combination. Therefore, the authors recommended the scoring formulas R-W/3 and R-W/4 be used for tests which contain instructions that mention a penalty for guessing.

Mollenkopf, W. G. Slow but how sure? The College Board Review, 1950 11, 147-151

This study was conducted to determine whether exceptionally slow working students who may be highly competent are handicapped by the time limits on the Scholastic Aptitude Test (SAT). Two verbal antonym tests and two mathematics aptitude tests were specially constructed for this investigation. Junior and senior high school students were divided into four comparable groups. The test forms were randomly distributed within the groups. All students while working under a fixed time limit (or speeded condition) answered questions with a red pencil; they then switched to blue pencils and completed the tests with no restriction on time (the unspeeded condition). These two conditions produced a speed and a form to which he was assigned. Correlation coefficients were computed between scores on each verbal and each mathematical test. The values observed for the two verbal tests were .94 and .91; those obtained for the two mathematical tests were .81 and .82. An inspection of scatter plots of speed and power scores revealed, however that a small but noticeable group of students were handicapped by the time restrictions.

Mollenkopf, W. G. An experimental study of the effects on item analysis data of changing item placement and test time limit. Pschometrika, 1950, 15(3), 291-315.

To examine the effects on item analysis data of changing the location of items or the test time, the author administered four specially constructed tests (two verbal and two mathematics) to a group of junior and senior high school students. Both of the verbal tests contained the same items, but the order in which the items were presented was different for each test. Each student received one of the tests (assignment was determined randomly) and responded under both speeded and unspeeded conditions. Thus, each received a speed and a power score on the test assigned to him. Item analysis of these test data produced values for (1) the item p value (proportion correct); (2) R (another difficulty index) (3) the item-test biserial correlations. The values of the various items on eachof these indices were systematically compared with one another. Undesirable characteristics for those items appearing late in the speeded tests were observed. An inspection of the scatter plots of the speed and power scores for each test revealed the existence of a small group of students who were apparently handicapped by the speeded condition.

Morrison, E. J. On test variance and the dimensions of the measurement situation. Educational & Psychological Measurement, 1960, 20, 231-250.

This study investigated the effects of varying time-limits on test score variance and the rate of response of examinees. Two types of reasoning tests, number series and matrices, were administered to a group of examinees under three conditions: (1) no time limit, (2) 45 minute time limit, and (3) 30 minute time limit. (Specially constructed parallel forms of each of the reasoning tests were used for each of the testing conditions.) A timing box was employed in the untimed condition to measure individual item response times. A slide prjector was utilized in the timed tests to control the length of time each item was exposed. The results indicated that, for these tests, the proportion of responses correct was essentially the same for the power and the time-limit conditions. Also, as a group, the examinees were able to adjust their speed in the time-limit situation so that they solved the same number of problems whether working in less than half the time they chose to work under the no time limit condition.

Myers, C. T. Introduction to symposium: the effects of time limits on test scores. Educational and Psychological Measurement, 1960, 20(2) 221-222.

In this introduction to a series of articles, the author advocates greater recognition of the effects of time limits on test scores. He identifies two possible influences in his preliminary remarks. The first occurs when the time limit includes the directions for the test. Frequently, examinees will skim or even skip the directions so that they can proceed with the items as quickly as possible. The second effect is a covert one. The author maintains that the educational system, by employing speed tests may be emphasizing the value of snap judgment and educated guessing over the value of careful, deliberate thought.

Peak, H. and Boring, E. The factor of speed in intelligence. Journal of Experimental Psychology, 1926, 9, 71-94

The authors presented an investigation of the speed factor in intelligence tests. Five subjects were tested: two of the subjects were male graduate students in psychology; the other three were advanced, undergraduate women. They were given two forms of the Army Alpha Examination and two forms of the Otis Self-Administering Tests of Mental Ability. Each subject was given the test alone with the experimenter and was timed for response rate on every item. From these data it was possible to determine what the score for any time-limit would have been. The authors concluded that a high correlation exists between score on an intelligence test, speed on the test, and speed on a simple reaction test. They assert that speed of reaction is the most important factor in individual differences in the intelligence test.

Porebski, O. A psychological and statistical study of speed and power as variable of human ability. Occupational Psychology, 1954, 28, 218-229.

This study explored the speed and power dimensions of human ability. Two hypotheses were tested: (1) speed and power are distinct factors of ability; (2) speed and power are the fundamental factors of ability. Correlational and factor analyses were performed on the test score data from a small sample. The first hypothesis was supported, the second was not. The theoretical basis for the triad theory of ability was discussed. This theory assumes that the quantitative aspects of ability can be representd by a general factor of speed, and the specific factors of speed.

Rindler, S. Test speededness: A review of the methodological literature. Paper presented at the annual meeting of NCME, 1975.

The purposes of this paper were to examine critically the methodological literature on test speededness and to provide suggestions for future research in this area. The author presented an extensive review of indices for tests speededness developed from single administrations or multiple administrations of tests, and various other procedures. The indices she discussed which had evolved from single administrations of tests were: (1) Gulliksen's variance ratios (2) Swineford's ETS criteria, (3) Donlon's confidence interval approach, (4) Staffords Speededness Quotient. Two indices which were produced from multiple administrations of the test were evaluated: (1) one proposed by Cronbach and Warrington and (2) one suggested by Lord. A few indices which were created by procedures other than the two identified above were also discussed: (1) one resulting from time and untimed administrations of the same test; (2) one produced from a multiple scoring of the same test administration; (3) one created from an untimed test condition during which the time an examinee required to respond to each item was noted; (4) one defined as the amount of time taken to complete the entire test; (5) one where the amount of time an item was exposed was controlled by a slide projection procedure.

Sisk, J.K. The interrelations of speed in simple and complex responses. George Peabody College for Teachers Contributions to Education, 1926, No. 23.

The study was conducted to investigate the interrelation of speed in different kinds of responses, both simple and complex. Five individual speed tests, five group speed tests, and the Army Alpha were given to 100 college students. The data seemed to justify the following conclusions: (1) a person who reacts quickly on simple tasks will probably do so on more complex ones; (2) persons who are quick in one complex reaction system will probably not be quick in another, nor will persons who are slow in one complex reaction system be slow in another; (3) persons who are relatively quick in simple reaction will be relatively quick in another; (4) a high score on the Army Alpha test is slightly related to the speed with which one is able to react to a complex situation.

Slater, P. Speed of work in intelligence tests. British Journal of Psychology, 1939, 29, 55-60.

To explore the relationship between speed rate and ability level, the author administered an adaption of the Thorndike CAVD tests to 450 public school children. He designed his experiment so that he could control for two factors which he maintained had contaminated the results of previous research in this area. First, he used times only for those items which examinees answered correctly; second, he did not instruct the examinees to work quickly but permitted them to choose their own work rates. The were asked to use a "number clock" to record their starting anf inishing times for each item on a series of four tests. Measures of intelligence were obtained from various non-verbal tests under fixed time limits. The total time required to respond to these items, either correctly or incorrectly, was used to calculate speed rates for these tests. A high correlation was observed between both measures of speed. However, only slight correlations were obtained between each of the speed scores and performance on the intelligence tests. Individuals appeared to maintain a consistent rate throughout the testing period regardless of the difficulty level or content-type of the items.

Stafford, R. E. The speededness quotient: A new descriptive statistic for tests. Journal of Educational Measurement, 1971, 8(4), 275-277.

A new, single-administration statistic is proposed to describe the speededness of a test. It is called the Speededness Quotient (SQ) and is defined as the percentage of unattempted items in the total number of errors. There are SQ formulas introduced which make the statistic suitable to use as an index of speededness for the individual, an item, or a test.

Sturt, M. A comparison of speed with accuracy in the learning process. British Journal of Psychology, 1921, 12, 289-300.

The purpose of this study was to determine whether speed or accuracy should be emphasized on tests which measure skills involving muscular activities. Two comparable groups of girls between the ages of 12 and 14 were taught basic typewriting skills. For one group, the instruction, which lasted six months, stressed the development or speed skills, The other group's instruction endured for the same period, but the acquisition of accuracy skills was encouraged. Whenever the girls were tested, they were advised to attend to both speed and accuracy. Although initially it appeared that the "accuracy" method produced more skillful typists, at the end of the school year, there was no significant difference between the mean scores of the two groups.

Sutherland, J. D. The speed factor in intelligence reactions. British Journal of Psychology, 1934, 24, 276-294.

Several problems related to rate of work in intelligence tests were identified in this article: (1) the possible existence of a factor of speed independent of level in intelligence reactions; (2) the possible existence of a factor of speed independent of the general factor 'g'; (3) the unknown nature of the time differences in intelligence reactions. To address the first problem, the author recorded the various times required by a group of subjects to solve a number of problems; a measure of level of intelligence was also obtained. Time correlated positively with level, as would be expected, but the relationship practically disappeared when the influence of the level factor was partialled out. Therefore, the author concludes that there is little evidence for an independent factor of speed when the conditions demand a uniform attitude of securing maximum accuracy at the greatest speed. However, when problems are of low difficulty, a factor of speed does influence the test score. He states further that intelligence is considered the general factor 'g', then no specific speed skill is involved in solving problems, whether they are easy or difficult. Finally, after administering several performance tests and analyzing the subjects' scores on the tests, the author concludes the time required to complete more complicated tasks is highly correlated with the number of steps taken.

Tate, M. W. Individual differences in speed of response in mental test materials materials of varying degrees of difficulty. Educational and Psychological Measurement, 1948, 8, 353-374.

This study was conducted to determine whether examinees' speed of response scores on mental test items could be utilized to differentiate among individuals of divers abilities. A second part of the study concerned the identification of a factor of speed which was independent of the content area being measured, and, also, independent of attitude. (Attitude was hypothesized by Thorndike to be one of the three dimensions of the intellect.) A sample of high school students enrolled in the college preparatory track were individually administered the California Test of Mental Maturity in the areas of arithmetic reasoning, number series completion, and spatial relations. The items in each content area were grouped into three item difficulty levels: high, medium, and low. The examiner measured speed of response to an item in seconds. Accuracy of response was scored as a one or a zero indicating a correct or an incorrect response. Analysis of variance techniques were employed on the speed scores with the different levels of content area, item difficulty, and accuracy. The results indicated that: (1) the subjects who were quick to respond to items at one level of item difficulty seemed to respond quickly to items at other levels; (2) subjects who responded quickly in one content area also responded quickly in the other three; (3) relative standings of the subjects on the speed measure were less affected by changes in the difficulty level of the items in a content area than by changes in the content areas themselves.

Tate, M. W. Notes on the measurement of mental speed. Journal of educational Psychology, 1950, 41, 219-236.

Problems which arise when one attempts to measure mental speed are discussed in this paper. The author offers several suggestions to the researcher exploring test speededness. These issues concern experimental procedures and materials, selection of measurement units, control of accuracy effects, and reliability. The author introduces a logarithmic method for obtaining normally distributed speed scores from regular time-scores which are generally measured in seconds. He supports this technique empirically by testing the following hypotheses: (1) times of response to mental test items, measured in log seconds, tend to be normally distrubuted in the individual; (2) times of response on a single item, measured in log seconds, tend to be normally distrubuted in a group of individuals.

Thorndike, E. L. The relation between speed and accurcy in addition. Journal of Educational Psychology, 1915, 5, 537-541.

To explore the relationship betwen speed of response and accuracy, the author conducted a class experiment annually for several yeasrs. Members of his class at Teachers College, Columbia University, were given an arithmetic test; the were required to make 1000 additions as rapidly as possible. The performance of the top 65 scores (score = number) answered in 100 seconds) was compared with that of the bottom 20 scorers. The quickest respondents averaged 150 additions per 100 seconds whereas the slowest averaged 37 in the same amount of time. Also, the quickest group averaged 7 errors per 1000 additions, while the slowest averaged 17 1/2 per 1000. These results indicate that the individual who adds quickly also adds more accurately.

Tinker, M. A. Speed, power, and level in the revised Minnesota form board, Journal of Genetic Psychology, 1944, 54, 93-97.

The purpose of this study was to conduct an analysis of speed and level in the power score on the Revised Minnesota Paper Form Board Test (RMPFBT). Two forms of the RMPFBT were given to 103 university sophomores. Fifteen minutes after the commencement of the test, the examinees were instructed to indicate the last item completed. Five minutes later, they were again asked to mark the last item attempted. Finally, the time needed to finish all items on the test was recored. The analysis of the power, speed, and level scores revealed that: (1) speed and power scores very independently; (2) speed and level account for considerably of the score obtained within a given time limit; (3) speed is more influential than level in determining the power score, especially after the examinees have had practice with the material.

Tinker, M. A. Influence of the speed attitude on test performance. Journal of General Psychology, 1934, 10, 465-469.

This study compared test performance when the time limits were extended and speed attitude maintained with performance when the time limits were extended and a leisure attitude was dominant. Two groups of freshman and sophomore college students were administered the Army Alpha for the study. One group received the tests under normal and doubled time limits, where the speed attitude was dominant; the other received the tests under normal and unrestricted time limits, where a leisurely attitude was dominant. No significant difference in performance was observed between the two groups.

Traub, R. E. & Hambleton, R. K. The effect of scoring instructions and degree of speededness on the validity and reliability of multiple-choice tests. Educational and Psychological Measurement, 1972, 32, 737-758.

This study investigated the effects of varying scoring instructions, degree of test speededness, and six of examinee on the reliability and criterion validity of scores on mathematics and vocabulary reasoning tests. Three types of scoring instructions were employed: one promised a small reward for omitted questions; another threatened a small penalty for wrong answers; the third informed examinees that their scores would be the number of correct answers and encouraged them to guess. Two levels of test speededness, speeded an unspeeded, were employed. A stratified random sampling procedure was used to assign 1091 eighth grade students to one of six experimental conditions (three types of scoring instructions and two levels of speededness.) Stratification variables were schools, sex, and intelligence. Other variables investigated were risk-taking tendancies, test anxiety, need achievement, and school achievement. The results of the analyses conducted generated several conclusions: (1) scoring instructions dramatically affect the tendance of examinees to omit items; (2) the instrucitons which encouraged examinees to guess provided the fewest omitted items as well as the largest number of correct and incorrect responses; (3) the performance of examinees was poorer when the administrations were speeded than when they were unspeeded; (4) sex was significant only on the mathematics reasoning test where the boys out-performed the girls. No conclusive statement could be made concerning the effectrs of scoring instuctions, degrce of speeded-ness, or sex on criterion validity. However, scores for the power condition were more reliable than those for the speed condition for both vocabulary and mathema-tical reasoning tests.

Traub, R. E. & Hambleton, R. R. Note of correction on the article entitled The effects of scoring instructions and the degree of speededness on the validity and reliability of multiple choice tests, Educational and Psychological Measurement, 1973, 33, 887-878.

This article is a note to correct two errors discovered in a previous study. The first involves the use of "stepped-up" Pearson product-moment correla-tion coefficients in an analysis where original correlation coefficients should have been employed. Although the conclusions offered in the original paper remain unchanged, the critical level or significance for the statistical tests must be raised from .05 to .10. The second error is an inadvertant interchange of some of the pairs of reliability estimates contained in Table 3 of the original publication.

Tyron, C. M. On the nature of speed and its relation to other variables. Journal of General Psychology, 1933, 8, 198-216.

Abstracts and discussions of eleven prominent investigations concerning the nature of speed and its relationship to other variables were presented in this paper. This discussions emphasized the experimental techniques employed and the results obtained in the analyses conducted. Tyron offers an interpretation of the theories which spawned these studies. She also summarized shte results of all of them: (1) an individual who accomplishes one task rapidly may or may not perform a different task with a similar speed; (2) higher correlations are observed between speed scores on those functions which involve the same psychological mechanisms; (3) there is little evidence for a high community of function between speed measured by a variety of tests and attitude measured by a variety of tests; (4) there is a differential speed for different psychological mechanisms; (5) high correlations observed between scores under two time conditions, i.e., normal and extended, may result from altitude ability alone.

Tyron, C. M. & Jones, H. E. The relationship between speed and attitude. Journal of Experimental Psychology, 1933, 16, 98-114.

To investigate the relationship between speed scores and attitude scores, the authors adminsitered four speeded tests to a group of 116 elementary psychology students. The material on which the students were exmined was pojected on a screen at four exposure rates with the duration of exposure controlled. After viewing each set of materials, the students were given completion tests on its content. Altitude scores were obtained through the use of the ocmpletion elements of Thorndike's CAVD tests. The results of the author's analysis suggested that: (1) the speed of mental processes has a negligible effect on the correlations between the test of altitude and tests given under widely varying time limits; (2) speed exerts only a slight influence upon the intercorrelations of the speeded tests. The authors conclude that no relationship exists between speed of comprehending simple narrative-descriptive material and the ability to make completions in complex materials.

Walter, F. C. A statistical study of certain aspects of the time factor in intelligence. Teach. Coll. Cont. Educ., 1927, 248.

A group of 165 sixth and seventh grade pupils, selected because it was thought that timed intelligence tests did not accurately assess their abilities, were administered the Stanford Revision of the Binet-Simon Tests, five group intelligence tests, several rates of reading tests and a speeded test constructed by the author. Three time conditions were imposed on each of the group intelligence tests: half, standard, and extended. The author used the Standford Test as a criterion agains which to access the differentially speeded intelligence tests. In addition, he created a composite criterion composed of school grades, school progress, teacher's ratings, certain achievement tests and the Stanford Revision Mental age. The author concluded that the extent to which the timed intelligence tests discriminated agains the slower pupils was approximately seven months in mental age.

Wesman, A. G. Effect of speed on item-test correlation coefficients. Educational and Psychological Measurement, 1949, 9, 51-57.

The arguments opposing the practice of conducting item analyses with items which have been taken under speed conditions were discussed in this paper. A study, the results of which suport these arguments, was also presented. The study specifically investigated the differences between the item-difficulty values and item-test corrlation coefficients of the speeded test and those of the power test. Two parallel forms of a general intelligence test were prepared and administered to a group of nursing applicants. In order to determine speed scores, the examinees were instructed to work the item on which theywere working at successive five minute signals. The author defined an examinee's speed score as the number of items he answered correctly in the first 10 minutes of testing. All were permitted to finish the test; the total number of correct responsec was defined as the power score. An item analysis was performed on each form separately for both speed and power scores. The results were significantly different for those items at the end of each form under each condition.

Yates, A. J. The relationship between level and speed on two intelligence tests. British Journal of Educational Psychology, 1966, 36(2), 166-170.

The Progressive Matrices Test (PMT) was administered to a class of first year engineering students under regular and extended time conditions so that those students of high ability and slow working rate could be identified. Those students whose regular time score placed them below the high ability group but whose extended time score placed them within the high ability group were selected to comprise a high-ability/slow working rate group. The author achieved a cross-validation of his results by giving the Nuferno Level Test (NLT) under similar time conditions. He also hypothesized that students who placed in the high ability/slow working rate group would score below expectation on objective tests with restrictive time limits. The hypothesis was partially supported. The results indicated that both the PMT and the NLT administered under time conditions were likely to underestimate greatly the intellectual capacity of the high ability/slow working rate group of students.